APPENDIX B
RISK ASSESSMENT

1. Risk assessment is the process of determining the level of risk associated with hazards that have been identified. A Risk Assessment Matrix is used to obtain a measure of the level of risk in terms of severity and probability, expressed as a Risk Assessment Code (RAC). Although Risk Matrices vary in the number and exact definition of categories, the basic concept of measuring degree of severity and probability remains the same.

a. Hazard Severity - An assessment of the worst credible consequence, defined by degree of injury, occupational illness, property damage, loss of assets (time, money, personnel) or impact on mission, which could occur as a result of a deficiency. Hazard severity categories are assigned roman numerals according to the following criteria:

(1) Category I - the hazard may cause death or loss of a facility/asset (i.e., Class A level damage).

(2) Category II - may cause severe injury, severe occupational illness, significant property damage, or severe degradation to the efficient use of assets (i.e., Class B level damage).

(3) Category III - may cause minor injury, minor occupational illness, minor property damage, or minor degradation to the efficient use of assets (i.e., Class C level damage).

(4) Category IV - would not significantly affect personnel safety or health, property, or efficient use of assets, but is nevertheless in violation of an established regulation or standard.

b. Mishap Probability - The mishap probability is the probability that the hazard will result in a mishap of the severity assigned, based on an assessment of such factors as location, exposure in terms of cycles or hours of operation, affected populations (throughout the Navy/Marine Corps), experience, or previously established statistical information. Mishap probability is assigned a letter value according to the following criteria:

(1) Subcategory A - likely to occur immediately or within a short period of time (one or more times within the next year).

(2) Subcategory B - likely to occur in time (within the next 3 years).

(3) Subcategory C - likely to occur several times during the life of the aircraft.

(4) Subcategory D - unlikely to occur, but is feasible within the lifetime of the aircraft.

c. Risk Assessment Code - The RAC is an expression of overall risk which combines the elements of hazard severity and mishap probability. As defined in the matrix shown below, the RAC is expressed as a single Arabic number that can be used to help determine hazard abatement priorities. This is the matrix used in several OPNAV instructions addressing risk management.

	Mishap Probability			
Hazard Severity	A	B	C	D
I	1	1	2	3
II	1	2	3	4
III	2	3	4	5
IV	3	4	5	5

RAC Definitions:

1 - Critical Risk
2 - Serious Risk
3 - Moderate Risk
4 - Minor Risk
5 - Negligible Risk

d. A further breakdown of RACs is necessary for the Naval Aviation Safety Program. A RAC of 1 or 2 is considered a severe hazard while a RAC of 3, 4, or 5 is considered routine. Severe hazards receive priority by COMNAVAIRSYSCOM when allocating resources for corrective actions, and COMNAVSAFECEN tracks all severe hazards until the corrective actions are complete. Severe hazards also require endorsements up to the action agency.

2. The following scenario is provided as an example of risk assessment:

A squadron is preparing a HAZREP in response to simultaneous precession of both the pilot and copilot Attitude Direction Indicators (ADIs) on a C-9 aircraft. Circumstances surrounding the incident were as follows: Shortly after taking off into the VFR landing pattern, both the pilot's and copilot's ADI began to precess. By the time the aircraft had turned to downwind, both ADIs indicated 30 degrees nose up and 20 degrees left wing down while the aircraft was in level flight. The crew executed a normal landing and the ADIs remained precessed while on the ground.

The following information is available to the squadron's ASO through community and COMNAVSAFECEN data:

- This incident is the seventh C-9 dual ADI failure documented in the last 3 years. The reason for the failures has not been identified.

- The C-9 has no standby ADI. When dual ADI failure occurs, the pilots must rely on external visual references or altitude and compass indicators for attitude information. These alternate indications are not accurate reflections of the aircraft attitude. Flying the aircraft in instrument meteorological conditions (IMC) with dual ADI failure would demand extraordinary concentration and skill of the pilots, and is likely to result in loss of control of the aircraft. As long as the aircraft is in visual meteorological conditions (VMC) when dual ADI failure occurs, safe recovery is considered likely.

- Over the past 5 years, C-9s averaged 18 percent of their total flight time in actual IMC. Significant change in flight hours or scheduling is not anticipated.

Given the above information, the ASO can assess the risk of this hazard in a fairly quantitative manner. If dual ADI failure occurs in certain conditions, loss of a C-9 aircraft, its crew and passengers is a credible outcome. Therefore, hazard severity in this case is I. The mishap probability (the probability that a severity I mishap will occur) depends on several factors. Since there have been seven dual ADI failures in the lasts 3 years, and the reasons have not been identified, it is reasonable to assume that failures will continue at the same rate - 2.33 incidents per year. If a mishap of severity I is only likely if the aircraft is in IMC, we can multiply 2.33 by .18 (the average percentage of time a C-9 spends in IMC) to obtain a predicted rate of 0.42 severity I mishaps per year. This gives it a probability of B, and a corresponding RAC of 1.

Other factors which would influence the probable outcome (i.e., pilot experience, altitude, flight configuration, etc.) should also be considered. If historical data is not available, the best estimate from available information should be used to assign the RAC.

3. Although hazard severity is normally based on the worst credible consequence, there may be situations in which evaluation of a lower category of severity is appropriate. For example, a multiengined aircraft with an engine hazard may have a remote probability (D) of catastrophic (category I) damage, resulting in a RAC of 3. However, this same engine hazard may be much more likely (probability A or B) to result in critical (category II) damage, resulting in a RAC of 1 or 2. In this case, the more severe RAC should be reported.